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Effects of a Phase II Cardiac Rehabilitation Program on Patient Depression

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Effects of a Phase II Cardiac Rehabilitation Program on Patient Depression

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Abstract

Background: Screening for depression upon intake and completion of a Phase II cardiac rehabilitation (CR) program may influence the type of interventions implemented by CR staff and reduce depression.

Objectives: We examined patients before and after a Phase II CR program who self-reported as depressed using the CES-D score and also assessed scores by procedure, gender and age. We further identified the types of interventions used for those who were depressed.

Methods: We conducted a pre-post intervention study. Using a convenience sample, data were collected on CES-D scores before and after the program and by type of procedure, gender, and age from May 1, 2013 to April 30, 2017. We conducted independent and paired t-test and ANOVA analyses.

Results: Among 132 patients, 25 (19%) self-reported as depressed and most who were depressed patients had at least one intervention (n=22, 88%). For the total group, patients had significantly lower mean CES-D scores at the end of the CR program (6.87 ± 6.64) compared to scores before they started (8.79 ± 8.09, t=0.53; p=0.003). For only depressed patients, CES-D scores were also lower at the end versus the start of the program (p<.001). No differences were found in level of depression based on type of procedure, gender or age.

Conclusion: Interventions used by CR staff were effective in decreasing depression scores from intake to completion of a Phase II program. Our results and recommendations were reviewed and discussed with the stakeholders to improve and standardize depression interventions.

Background

Cardiovascular disease is one of the leading causes of death worldwide (World Health Organization [WHO], 2017) and Benjamin et al. (2017) reported that in 2010 over 7.5 million cardiac procedures were performed annually – up 28% from 2000. Yohannes, Doherty, Bundy & Yalfani (2010) explained that cardiac rehabilitation (CR) reduces mortality and morbidity while Peck et al. (2013) add that for each session attended, mortality can be reduced by 1%.

While the focus of a Phase II CR program primarily aims to restore the individual to an improved level of physical activity and assist in making lifestyle changes, there is a need to consider the patient's psychological well-being. Sunquist, Chang, Parsons, Dalrmple, Edmonson, and Sumner (2016) estimated that up to 20% of patients who have had a cardiac event are depressed – increasing risk of mortality. Harenburg, Marshall-Prain, Dorsch, & Riemer (2015) and Jackson, LeGrande, O'Higgins, Rogerson & Murphy (2017) both suggested that CR programs that "incorporate psychosocial and education-based CR may improve the health-related quality of life" (p. 65). Therefore, patients are routinely screened at our institution for depression upon his/her initial intake appointment as recommended by Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) occurring approximately six weeks after the initial cardiac event. Screening for depression during a participant's initial visit the level of depression can impact his/her motivation to complete a program and ensure that his/her mortality from future cardiac events are prevented (Peck et al., 2013).

Problem Statement

At our institution, when a post-cardiac event patient is referred for Phase II CR the patient will complete intake forms including depression screening using the Center for Epidemiologic Studies – Depression (CES-D) scale. Once the patient has completed the CES-D

form, the CR staff reviews the form and score the patient using a standardized process. Ski, Page, Thompson, Cummins, Salzberg and Worrall-Carter (2012) suggested that depression may not be a priority to healthcare workers and that they may mistake depressive symptoms as part of adapting to a new lifestyle and/or medications. Recognizing that CR staff may not be prepared to speak to these patients, or have a reasonable comfort level with these discussions, the AACVPR has provided resources to be used to during sensitive discussions.

Other factors to consider that may impact the depression score include type of procedure, gender, and age. Hazelton, Williams, Wakefield, Perlman, Kraus & Wolever (2014) reported that women have greater psychological needs and are more prone to depression following a cardiac event, therefore Davidson (2011) suggested that women, when given a gender-based framework with tailored interventions, improve depressive symptoms. By examining depression rates before and after the CR program by age and gender, this may assist in developing individualized programs to increase quality of care and improved outcomes to the patient (Gellis and Kang-Yi, 2012).

Purpose

The primary purpose of our study was to describe how many post-cardiac event patients who have come through a CR program self-identified him/herself as depressed using the CES-D tool and determine the severity of the depression. Differences in levels of depression of patients were evaluated before and after the CR program and were assessed for differences by procedure, gender and age.

In addition, a secondary purpose of the study was to identify whether some type of intervention was used by CR staff for those patients self-perceived as depressed and assess the types of interventions.

Aims

The specific aims of our study were to:

1. Measure the level of depression in Phase II CR patients post-cardiac event.
2. Compare the level of depression of Phase II CR post-cardiac event before and after the CR program by type of procedure, gender, and age.
3. Assess whether interventions were implemented by the CR staff for depressed patients post-cardiac event.
4. Evaluate the types of interventions that were implemented by CR staff for depressed patients post-cardiac event.

Research Questions

The following research questions were assessed:

1. Were interventions implemented by CR staff for depressed patients post-cardiac event?
2. What types of interventions were implemented by CR staff for depressed patients post-cardiac event?

Hypotheses

The following research hypotheses were tested:

1. There is a difference in level of depression at the beginning of a Phase II CR program in patients post-cardiac event and by the end of up to 36 sessions of a Phase II CR Program.
2. There is a difference in the level of depression at intake of Phase II CR patients post-cardiac event by type of cardiac procedure.
3. There is a difference in the level of depression at intake of Phase II CR patients post-cardiac event based on gender.

4. There is a difference in the level of depression at intake of Phase II CR patients post-cardiac event based on age.

Significance

Many validated tools are available to use for screening of depression, and per AACVPR (2017) guidelines, a Phase II program may choose any validated tool. Currently the CES-D is being used within our organization; however, Cahill, Bilanovic, Kelly, Bacon, and Grace (2015) recommend a tool that is applicable to a cardiac population.

Our study examined whether consistent depression screening was completed at intake of the CR program and if standardized pre-documented interventions were documented before and at completion of the CR program. Despite using a validated tool, when screening for depression in the CR patient, our CR staff may not have considered the significance of the score and how it may have related to the patient's attendance in a CR program in relation to the type of procedure, gender or age of the patient. Gaps in accurate screening could lead to a patient not receiving treatment for mild to severe depression which could interfere with his/her success in a program (Casey, Hughes, Waechter, Josephson and Rosenick, 2008; Bunevicius, Staniute, Brozaitiene, and Bunevicius, 2012; Cahill et al., 2015).

Interventions are based on the CR staff's access to resources to discuss depression for the patient who is post-cardiac event; however, these resources may not be sufficient or aimed at specific procedure type, age or gender. Therefore, a program armed with tools and resources based on age and gender may be beneficial for the CR staff when providing interventions for the post-cardiac event patient.

As a result of our study, changes to policy at the facility level has the potential to expand to the system team after assessing the impact at our facility. A standardized list of resources for

interventions ensures continuity of care is maintained for all patients within the health system. Additionally, programs may need to adjust operationally based on findings of gender and/or age groups to individualize care as much as possible. Casey et al. (2008) reiterate "assessing for depression in cardiac rehabilitation and employing interventions that target depressed patients might improve overall rates of completion in cardiac rehabilitation" (p. 429). As a long-term goal, this could influence a patient enrolling into a Phase III program (self-pay) which financially benefits the organization while improving the patient's quality of life and outcomes.

Literature Review

While there is an abundance of literature supporting CR programs being beneficial for physical and psychological well-being, sample sizes remain small suggesting the need for larger trials (Casey et al., 2008). The literature was further explored by reviewing benefits of a Phase II CR program with relation to: depression screening, the types of tools that may be used for depression screening, the types of interventions for depression that may be employed in a CR program, depression and the type of cardiac procedure a patient may have had, age considerations, and how depression and gender differ.

Cardiac Rehabilitation and Depression Screening

Much of the literature surrounding depression screening and patients who participate in a CR program reinforce that patients do significantly better when their psychological needs are met in addition to his/her physical needs (Ski, Page, Thompson, Cummins, Salzberg & Worrall-Carter, 2012; Turner, Phillips, Hambridge, Baker, Bowman, & Colyvas, 2010; Jackson, LeGrande, O'Higgns, Rogerson, Murphy, 2017). In Ski et al.'s (2012) study using the CES-D, 54% of patients identified had depressive symptoms with 19% reported as moderate and 35% reported as severe. These researchers emphasize there is a misconception of healthcare workers

that depression is a normal response that is to be expected after a patient has a cardiac event; therefore, symptoms of depression such as fatigue (more common in women [Davidson, 2013]), loss of appetite or sleep disturbances may go unnoticed during a depression screening in the Phase II CR program.

Turner et al. (2010) studied 389 records of patients examining the relationship between depression, anxiety and levels of social support and clinical outcomes. While the interval of depression screening was not been clearly defined, at our facility, according to P. Killingworth (personal communication, February 20, 2017), "an initial depression is done on intake, and then again at session 12 or before if there is risk of a patient ending a program sooner."

The literature also revealed that screening was not done as commonly thought. Cahill et al. (2015) discovered in three studies specific to CR program depression screening compliance can varied from 29-68% of the time and explained that "those patients who received treatment were significantly more likely to being screened than those who were not treated" (p. 227) signifying that there may be missed opportunities for patients who have not been identified as depressed.

In Jackson et al.'s (2017) study, 95% (n=157) of CR staff screened upon a patient's entry into a Phase II program for depression and that 80% (n=132) of CR staff performed an exit screening for depression further demonstrating the continued need to ensure all patients are screened and a standardization in frequency of follow-up depression screening up until the end of a patient's Phase II program.

Cardiac Rehabilitation and Validated Tools

Although there were few studies to demonstrate which validated tool may be most effective and accurate in a cardiac population Lictman, Bigger, Blumenthal, Frasure-Smith,

Kaufmann, Lespérance et al.(2008), Benevicius et al., (2012), and Jackson et al. (2017) described several tools other than the CES-D that may be useful in screening for depression in a Phase II CR patient post-cardiac event. These tools included the Hospital Anxiety and Depression Scale (HADS), Beck Depression Inventory-II (BDI-II), Patient Health Questionnaire 2 and 9 (PHQ2, PHQ-9), and HeartQoL. While Lichtman, et al. (2008) suggested that while the PHQ-2 be completed at a minimum, "any of these tools can provide a useful initial assessment…" (p. 20) suggesting CR program administrators should determine which validated tool may work best for the patients the organization serves.

Cardiac Rehabilitation and Interventions for Depression

Intervention and treatment options were also explored and vary in the literature. Pharmacologic options may be necessary for patients scoring severe depression after consultation with his/her physician, however, many non-pharmacologic options are available. Gellis and Kang-Yi (2012) found in their meta-analysis of eighteen studies (3, 827 patients) aimed at randomized control trials (RCTs) of interventions in CR patients aged ≥ 64 years old, non-pharmacologic interventions employed by CR staff included telehealth, home-based interventions, tailored interventions of self-disease management and deep-breathing exercises, and collaborative care. Gellis & Kang-Yi (2012) recommend that additional skills CR staff may wish to develop include motivational interviewing and/or psychosocial interventions. Gellis & Kang-Yi (2012) encouraged CR programs to have an interprofessional approach "with the goal of decreasing cardiovascular risk, increasing healthy behaviors and functioning, and promoting an active lifestyle using medical management, nutrition, psychosocial interventions, exercise, and behavioral activation" (p. 1223).

Whalley, Thompson and Taylor's (2012) systematic review and meta-analysis of sixteen studies from the 2004 Cochrane Review examined psychological interventions and recommended the following interventions: self-awareness and self-monitoring exercises, relaxation techniques, risk education, emotional support or client-led discussions, homework, guidance on successful behavior change and cognitive-restructuring techniques. Through their review, Whalley, Thompson and Taylor (2012) learned that there was a significant reduction in depression with treatment (SMD -0.21, (-0.35 and -0.08), heterogeneity x^2 (11) = 36.36, df = 11, p = 0.0001, I^2 = 70%).

Divided into two areas of interest, Rutledge, Redwine, Linke, and Mills's (2013) meta-analysis revealed that those CR programs that had interventions addressing depression had better outcomes as evidenced by mortality rates (ARR=0.016, 95% CI = 0.002-0.019, NNT = 63) with an average duration of 13.3 weeks. The other area of interest in Rutledge et al.'s (2013) study included the use of antidepressant medication in nine studies (fluoxetine, sertraline, paroxetine, and citalopram) and two psychotherapies (cognitive behavioral therapy [seven studies] and stress management [eight studies]) which demonstrated no relationship between Cohen *d* values. Therefore, Rutledge et al. (2013) suggested that the above interventions may have a small to moderate effect on depression severity in patients in a CR program.

Improvements in depressive symptoms using collaborative care (CC) demonstrated a significant intervention (p=.002) for depressed cardiac patients by Huffman et al. (2014) in their single-blind RCT (Management of Sadness and Anxiety in Cardiology [MOSAIC]) (n=183). Collaborate care incorporated interprofessional collaboration amongst front-line CR staff (registered nurses and exercise physiologists) with mental health case workers, and social work ensuring the best treatment/interventions were being utilized for cardiac patients.

Assessment of Interventions on Depressed Patients with Coronary Artery Disease

There is little literature to assess the effect of interventions on patients who self-report as depressed. Pogosova et al. (2015) reported in a position paper that interventions such as psychological counseling, or referral to a provider that may prescribe medication in conjunction with an aerobic exercise training program (such as CR), influence depressive symptoms resulting in patients reporting an increase in mood at the end of a program compared to at the beginning.

In Klainin-Yobas, Ng, Stephen and Lau's (2016) systematic review and meta-analysis of psychosocial interventions and psychological outcomes among patients with cardiovascular diseases, the researchers reported 18 of 30 studies used depression as an outcome with average effect size (g=0.67, p<0.001). Klainin-Yobias et al. (2016) discovered that "psychosocial interventions produced significant positive effects on depression…" (p. 518) which included: transcendental meditation plus health education (g=1.35, p<0.001), in-hospital counselling followed by telephone sessions (g=0.51, p<0.04), and motivational interviewing (g=0.34, p=0.01).

Egger, Schmid, Schmid, Saner and von Känel (2008) studied depression and anxiety with CR as the intervention to determine if exercise capacity and body mass index (BMI) would decrease. The results of Egger et al.'s (2008) study demonstrated a reduction in depression scores (p<0.001) when CR was implemented. However, in Sebregts, Falger, Appels, Kester and Bär's (2005) study, incorporating behavior modification into a CR program for acute MI and CABG patients decreased hostility levels (p<.01), but did not significantly decrease depression in this population (p=0.48).

Cardiac Rehabilitation and Type of Cardiac Procedure

The type of cardiac procedure may influence the level of depressive symptoms. Szczepańska-Gieracha, Morka, Koawlska, Kustrzycki and Rymaszewska (2012) explained in their RCT of 50 CABG patients that patients who had a CABG tended to have poorer acceptance of his/her illness state ($p<0.001$) compared to percutaneous coronary intervention (PCI). The poor acceptance could be related to longer recovery process from major surgery as compared to an elective percutaneous procedure. There were few studies that determined if type of procedure impacted level of depression; however, most were related to post CABG surgery, but not PCI. Additionally, many patients who may be diagnosed with CAD may not be candidates for CR, however, this population being treated medically are at risk for depression.

Cardiac Rehabilitation and Age

The age of a patient post-cardiac event and the level of perceived depression has also been reported in the literature. Casey et al. (2008) studied 600 patients of which the average age was 66±12 years of age. Casey et al. (2008) explained that while there was no significant relationship between depression and age ($r = -.07$, $p>.05$), during a second logic regression, patients aged 65 years and older were slightly greater than two times more likely to complete a CR program while also reporting patients who are <65 years of age often do not complete a program due to other commitments such as returning to work ($p<.01$).

Tolmie, Lindsay, Kelly, Tolson, Baxter and Belcher (2009) completed a small study of 31 men and women aged greater than 65 years in which depression correlated with increased age in cardiac patients; however, with a CR program that encouraged exercise and psychosocial interventions, the depression was decreased.

Cardiac Rehabilitation and Gender

Grace, Yee, Reid and Stewart (2014), Davidson (2013), and Hazelton et al. (2014) suggested that gender can influence participation and outcomes of a CR, thus requiring the program to meet the needs of gender differences. Women were twice as likely to experience depression as compared to men, therefore, considerations by the CR staff should be taken when screening women, and particular attention to interventions individualized for their care should be met. In their study, Grace, Yee, Reid and Stewart (2014) studied 1784 patients between a period of one year in 11 facilities in Canada discovering fatigue was a significant symptom; therefore, careful attention should be given to women who report high levels of fatigue.

Hurley, Arthur, Chessex, Oh, Turk-Adawi, and Grace (2017) completed a multi-center trial of 128 women who were randomized into three types of CR model: 1) mixed-sex traditional CR, 2) women-only hospital-based, and 3) home-based CR and discovered although the preference for a women-only program was preferred, patients who demonstrated depressive behaviors sought pharmacologic treatment from their primary care physician to treat the depression. Davidson's (2013) study of 252 randomized patients reinforced utilizing a gender-based program in reducing CES-D scores from entry into a program to completion ($p<0.001$).

Zimmerman, Barnason, Hertzog, Young, Nieveen, Schultz, and Tu (2010) studied 232 subjects in a two-group, RCT to examine gender differences. Their study demonstrated that there were differences in recovery outcomes and levels of depression between men and women attributing this to social roles, especially in home management which could contribute to psychological neglect. Zimmerman et al. (2010) reported women had a heavier symptom burden (fatigue, depressive symptoms, sleep problems and pain) than men) ($p<.05$); therefore, men exhibited higher levels of physical activity.

Beckie et al. (2011) studied 225 women in a two-group RCT comparing depressive symptoms using the CES-D tool in a traditional CR program versus a tailored program that included motivational interviewing techniques. The researchers demonstrated baseline CES-D scores were 17.3 and 16.5 for the tailored and traditional group respectively and post intervention scores of 11.0 and 14.3 ($p<.001$). These results suggest that a gender-tailored CR program using motivational interviewing techniques may be required for organizations to consider (Beckie et al., 2011).

Theoretical Foundation

The Health Belief Model (HBM) developed in the 1950's by Hochbaum, Rosenstock and Kegels (Shanks, 2009) is a psychological model that attempts to explain and predict health behaviors by focusing on the attitudes and beliefs of individuals. The HBM is based on the understanding that a person will assume a health-related action (in this case for depression) if that person: 1) feels that a negative health condition (i.e. depression) can be avoided, 2) has a positive expectation that by taking a recommended action, he/she will avoid a negative health condition (i.e., participating in a Phase II CR program post-cardiac event), and 3) believes that he/she can successfully select a recommended health action (i.e., use healthy lifestyle changes to promote physical and psychological health).

Using the HBM in assessing depression screening in the post cardiac-event patient, this may provide some insight as to how many sessions a patient may complete and in assessing whether interventions by CR staff were successful by either decreasing the patient's perceived depression or successful completing (and continuing) a CR program.

Identifying and Defining Variables

To assess perceived level of depression, the validated CES-D tool was determined to be the dependent variable in this study. Appendix A lists the dependent variable, any confounding variables that may have been identified, and the independent variables. Although several independent variables are listed, the independent variables used to test against the dependent variable included: type of cardiac procedure, gender and age before and after a phase II CR program.

Methods

Research Design

Our pre-post intervention study used retrospective data in determining the level of depression in Phase II cardiac rehabilitation patients post-cardiac event upon intake and completion of the program. This design was chosen for two reasons: the study was time-sensitive and was found to be a good fit for the research questions of determining severity of depression by procedure, gender and age. Data were examined initially separately by each category (procedure, gender, age) and then on a secondary level by how each related to each other. For example, data were used to determine if there is a difference in depression by age and gender.

Study Population/Sample

The outpatient Phase II CR program at our facility in the metropolitan Phoenix, AZ region cares for many patients with varying cardiac-related disorders; however, for our study the target population was post-cardiac event Phase II cardiac rehabilitation patients who participated at our facility. A Phase II CR patient for this purpose was a patient entering an elective program of cardiac rehabilitation after approval from insurance and prescribed by the cardiologist post-cardiac event. A Phase II program is typically approved for up to 36 sessions lasting approximately 12 weeks (Servey and Stephen, 2016) that is supervised and led by registered

nurses (RNs) and/or exercise physiologists (Ex Phys). During this time, a patient will undergo continuous cardiac monitoring as the CR staff progress the patient's activity level. Other professions that the patient may have contact with are dieticians, physicians, and behavioral health specialists (Servey and Stephens, 2016).

A patient who was considered post-cardiac event was divided into three categories: 1) a patient who has had symptoms of cardiac disease (chest pain, positive stress test, borderline cardiac biomarkers, myocardial infarction [STEMI and NSTEMI], or unstable angina)(medical therapy), 2) having had an elective or emergent invasive cardiac procedure such as percutaneous coronary intervention (PCI) (i.e. balloon angioplasty, coronary stenting, structural heart procedure [i.e. TAVR]), or 3) a patient having had an elective or emergent surgical intervention (coronary artery bypass graft [CABG] or valvular surgery.

Inclusion and Exclusion Criteria

We aimed to include a convenience sample of 700 subjects who met the inclusion criteria from May 1, 2013 to April 30, 2017. Subjects were included in the study if they:

- Had approval from provider and insuring agency for Phase II Cardiac Rehabilitation of up to 36 sessions over a 12-week period
- Were male or female age 18 years or older of all ethnic origins and all racial groups
- Had a cardiac procedure (percutaneous coronary intervention [PCI], and surgical procedure [i.e. CABG, valve procedure], elective or emergent)
- Had a cardiac event, but are being treated medically (i.e. chest pain, positive stress test, borderline cardiac biomarkers, myocardial infarction [STEMI and NSTEMI], or unstable angina

- Completed a CES-D depression screening at least two times (at intake and completion of program [minimum of 12 sessions])

Patients were excluded from the study if they:

- Had a primary diagnosis of heart failure (Class I-IV)
- Were admitted for elective cardiac implant devices (i.e. permanent pacemakers, automated internal cardiac defibrillators [AICD])
- Were in pulmonary rehabilitation
- Had a primary history of depression, anxiety, or other psychiatric disorder (i.e. bipolar, substance abuse)
- Were Phase I CR patients (inpatient status) or Phase III CR patients (private pay)

Sample Size

Using the program Creative Research Systems 2012 to determine sample size, data were entered into the system as follows: confidence level of 0.95 and confidence interval (CI) of 0.8 and I determined the population by using an average of 40 subjects per quarter in the database resulting in approximately 160 participants per year. The number of subjects over four years totaled 640 potential subjects. Using this data in the calculator the result of 614 subjects was determined to be the required sample size. Furthermore, I entered the CI into an additional calculator resulting in a CI of 0.8. Burns and Grove (2011) recommend as the number of variables increase, the sample size may also need to increase; therefore, 700 subjects would be an adequate sample based on the variables of type of procedure, gender, and age compared to level of depression. The actual sample size who met full criteria was 132 subjects.

Setting

Our CR department encompasses approximately 2000 square feet total with 800 square feet dedicated to exercise space with multiple modes of cardiovascular endurance training equipment (i.e. treadmill, elliptical and stationary bikes) and strength endurance training (free weights and stationary weight equipment) including a warm-up area. The remainder of the space consists of offices for staff, an education classroom, and storage. Cardiac monitoring is performed via a telemetry pack with a centralized monitoring system in which one CR staff member is present during designated exercise times (M. Trombley, personal communication, April 17, 2017).

The CR staff consists of registered nurses and exercise physiologists who are trained through an orientation program of up to 6-12 weeks depending on healthcare experience. Competencies (knowledge, skills, and attitudes) set forth by the AACVPR (2017) are validated by a designated preceptor and documented on the competency achievement plan (CAP). Knowledge components include regulatory and system specific items such as: depression screening (CES-D), outcomes measurements, tobacco cessation, disease specific health information (i.e. stroke, myocardial infarction, heart failure, etc.), exercise progression/prescription, documentation, and cardiac rhythm identification. Validation of technical skills include performing tasks such as obtaining a blood pressure, application of oxygen delivery, doppler mean arterial pressure measurement, and emergency management (i.e. cardiopulmonary arrest [code blue]).

Phase II Cardiac Rehabilitation Program

Once a patient has been prescribed by the provider and approved by the insurance company (private or Medicare/Medicaid) for Phase II CR, the initial intake visit will consist of completing many forms including: a thorough history and physical (H&P), individualized

treatment plan (ITP), and surveys for outcomes for quality of life (QoL), depression, nutrition, and functional capacity. At this time, baseline measurements including height, weight and vital signs are taken and recorded on the outpatient flowsheet. The patient is placed on a portable cardiac monitor and an individualized exercise plan is developed consisting of initially cardiovascular exercise. Patients are given a 5-minute warm up routine to complete before starting aerobic exercise. During a patient's exercise, the RN or exercise physiologist will monitor the patient's heart rate and rhythm, and assess vital signs (blood pressure, respiratory rate and oxygen saturation [O_2 sat]) and Rate of Perceived Exertion (RPE) (scale ranging from 0-20) halfway through his/her exercise routine. Patients are encouraged to control their RPE between 13-15 by adjusting the intensity of the workout to maintain this range. Once the patient has completed the exercise program for the session, he/she will cool down using the same routine as the warm-up exercises and stretching. Patient's vital signs are then reassessed once they have cooled down. If there have been no problems, the patient is taken off the cardiac monitor and is discharged for the session.

Patients are encouraged to attend a minimum of 12 sessions and complete a full program of 36 sessions. During each session after the initial session, patients are progressively advanced in the level of activity and type of exercise he/she will complete with the assistance of the RN and/or exercise physiologist. In addition to individualizing the CR plan for the patient, the CR staff will recommend a consultation or attendance of classes such as dietary assistance, stress management, music therapy, smoking cessation, cardiac medications, exercise/weight training, signs and symptoms of MI, other cardiac risk factor classes including blood pressure, and cholesterol. At sessions 12 and 24, the CR staff will evaluate the patient's progress on his/her ITP and adjust the plan accordingly. A full re-evaluation is completed within six sessions of the

patient's last Phase II visit (between session 30 and 36) which includes: any changes to the patient's H&P, ITP, and all previous surveys completed at intake (QoL, depression [CES-D], nutrition, and functional capacity. The data collected is reported to the Montana national outcomes database per AACVPR (2017).

Instruments and Measurement

Demographic data were collected to describe the sample which included educational level, race/ethnicity, marital status, housing situation, employment, and medical insurance coverage. Clinical characteristics included: admitting diagnosis, past medical history of psychological disorders, and substance use. Clinical data were collected related to the number of weeks or sessions completed in CR. Independent variables included time (assessment of depression at beginning and completion of program), procedure type, gender, and age which were accessed from the EHR.

Patients who met the inclusion criteria had completed the CES-D scores at the beginning of the CR program session one (week one) and ideally again at the completion of a full program (session 36, week 12); however, a patient could have voluntarily completed a program at varying session intervals due to a variety of factors, therefore we set the minimum number of CR sessions to be 12.

Harrenberg, Marshall-Prain, Dorsch, and Riemer (2015) explained that the CES-D tool is a reliable and valid tool commonly used in assessing for depressive symptoms in the post-cardiac procedure patient and is "considered a standard measure of depressive symptomology and has become the most widely studied depressive scale for the evaluation of depressive disorders" (p. 320) and is invariant across gender. Developed in 1977 by Laurie Radloff, the CES-D is a validated form using test-retest correlations (r=0.53) and reported internal consistency of

Cronbach alpha of 0.85 in the general population and 0.90 in the patient sample of psychiatric patients in New Haven, CT (Radloff, 1977). Hann, Winter and Jacobsen (1999) support the high reliability and report a Cronbach alpha of 0.85. The CES-D has been revised most recently in 2004 by William Eaton and others (Centers for Epidemiologic Studies Depression Scale Revised, n.d.).

The CES-D consists of 20 self-report items that measured the perceived emotions of depression in the previous week and is measured by using a 4-point Likert-scale for responses including rarely (0), sometimes (1), occasionally (2) and most times (3); however, there were four questions that needed to be reverse scored: question numbers 4, 8, 12 and 16.

After completion of the CES-D form at intake by the participant, the CR staff scored the patient responses using the tool to determine level of depression present. A score of 0-15 on the CES-D indicated the patient did not self-report as depressed. Patients who scored 15-22 on the CES-D indicated the patient self-reported as mildly depressed, and a score of greater than 22 may have indicated severe depression. For mild or severely self-reported scores, an automatic notification to the referring provider was completed during the initial visit. Interventions varied - mild depression interventions may include non-pharmacologic behavioral modification such as coaching with or without motivational interviewing, guided imagery, deep breathing exercises, relaxation and stress management classes, providing handouts, or encouraging social interactions in the outpatient setting. For patients self-reported as severely depressed and in in need of immediate assistance, interventions for mildly depressed patients are employed and the patient is instructed to consult with the referring provider (primary care or cardiologist) or accompanying the patient to an acute psychiatric facility or emergency department.

Data Collection Procedures

The principal investigator (PI) completed a Master's of Science in Nursing with Education (MSN-Ed) in 2010 and is a Doctor of Nursing Practice (DNP) student at The George Washington University in the Health Care Quality (HCQ) track. Ten percent of the sample was reviewed for accuracy in data entry by the Director of Research at our facility who also has administrative access to the data in the EHR and SharePoint with two corrections to the data results.

Data required for the study were stored on a secured system within the EMR which requires an assigned username by the Information Technology (IT) department and password created by the PI which was changed every three months to ensure security. Data were also accessed through a password-protected share point with access only being allowed by the administrator's permission. The PI's office is located in the cardiovascular services area in a large, urban university affiliated teaching facility with 665 licensed inpatient beds and is shared with one other person. The office has multiple covered shelves that are capable of being locked if there are data being recorded on paper. The door to the office was also locked when not in use as added security for protection of sensitive material.

The medical record number (MR#) was kept secure until all data collection was completed and then I deleted the MR# from the data collection tool before data analysis. The data collection tool (Appendix B) was created in electronic format (Excel spreadsheet) to collect and store the data with a data definition code sheet (Appendix C). In the event data needed to be re-examined or reviewed for accuracy, use of a coded identifier list/master log served as the link to any patient identifiers (Appendix D) as required by the organization. Potential for error in accuracy may be evident if there were hand-written interventions in the chart (CR flowsheet) making legibility a potential threat to reliability and validity to the data if interpreted in error.

Data Analysis Plan

Once data were checked for accuracy and cleaning completed, the statistical software analysis programs (SPSS 24) was used for descriptive statistics of number, and percent of patients were performed for all the demographic data and independent and dependent variables. In addition, descriptive statistics were performed to identify whether interventions were used and the types implemented by CR staff for depressed patients post-cardiac event. Our study included nine categories of confounding variables relating to interventions used. Independent variables included age (three levels), gender, and three procedure types (0=No procedure, 1=PCI, 2= Surgical). Demographic information included education (two levels), race/ethnicity (five categories), marital status (two categories), housing status (three categories), employment (two categories), medical insurance (two categories), admission diagnosis (4 categories), past psychiatric history (yes or no) and substance abuse (three categories)

The first hypothesis (H1) of whether there was a difference in level of depression at the beginning of a Phase II CR program in patients post-cardiac event and by the end of up to 36 sessions was analyzed using paired t-test (actual CES-D score). An ANOVA (reported as *F* statistic) was performed to answer the second hypothesis (H2) of whether there was a difference in the level of depression at intake of Phase II CR patients post-cardiac event by type of cardiac procedure. To analyze the third hypothesis (H3) of a difference in the level of depression at intake of Phase II CR patients post-cardiac event based on gender, an independent t-test was conducted. ANOVA was used for hypothesis four (H4) of whether there was a difference in the level of depression at intake of Phase II CR patients post-cardiac event based on age. Level of significance was set at 0.05.

Ethical Considerations

Our study had support from the Department of Professional Practice (DoPP) at our CR medical center. Our study was approved as expedited by our CR program's Institutional Review Board (IRB) and The George Washington University (GWU) IRB. Measures to prevent breach of secure data from occurring included limitations for those with access to data (primary researcher, CR supervisor, and director of nursing research at our facility). There were no anticipated risks to physical or mental well-being as the data is retrospective.

Between data collection and analysis, data collected on a secured-thumb drive provided by our research department were stored in a secured cabinet in the PI's office which was accessible to the PI and Director of Research at our facility.

Patient data were kept strictly confidential, anonymous, and de-identified with all data being deleted after 5 years (per our CR medical center protocol).

Results

Demographic and Clinical Characteristics of the Sample

For the total group (Table 1), most of the Phase II CR patients had PCI (n=77, 58.3%) or CABG (n=49, 37.1%). The majority primary diagnosis for this patient sample was CAD (n=63, 47.7%) followed by Other (n=56, 42.4%), unstable angina/NSTEMI (n=9, 6.8%) and STEMI (n=4, 3.3%). Participants (n=132) spent a mean time of 10.04 ± 2.69 weeks in the program.

For the total group, most patients were 65-79 (n=63, 47.7%) years of age and most were male (n=82, 62.1%). The majority were White/Caucasian (n=108, 81.8%), completed post-secondary education (n=112, 84.8%), were married (n=77, 58.3%) and not employed (n=102, 77.3%). All the patients (n=132, 100%) had housing and insurance coverage (data not shown in Table 1). The majority of the patients did not have a psychiatric history (n=113, 85.6%) and did not have any substance abuse (n=107, 81.8%, Table 1).

Research Questions Results of Interventions

There was a total of 132 participants who met full study criteria – of which 25 self-reported mild (n=14, 56%) or severe depression (n=11, 44%). The types of interventions the CR team used for depression (Figure 1) varied for all Phase II CR patients (n=132), and differentiated for those that self-reported as depressed (n=25, 19%). For all patients, the majority did not receive any type of intervention (n=84, 63.6%) from the CR team while in the program. For the 48 (57.1%) patients who received an intervention in the total group, many received a referral to stress management class (n=29, 60.4%), coaching (n=23, 47.9%), other (n=16, 33.3%), social interaction with other CR participants (n=11, 22.9%), referral to provider (n=8, 16.7%), motivational interviewing (n=6, 12.5%), patient handouts (n=1, 2.1%), or relaxation techniques (n=1, 2.1%).

Of those patients who self-reported as depressed (n=25, 19%), the majority did receive at least one intervention (n=22, 88%). Interventions that were most commonly utilized for patients self-reported as depressed included: coaching (n=14, 56%), stress management (n=13, 52%), referral to provider (n=11, 44%), other (n=9, 36%), motivational interviewing (n=4, 16%), social interactions (n=2, 8%) and handouts (n=1, 4%). Deep breathing, guided imagery and relaxation techniques were not used for those who self-reported as depressed.

Hypothesis Testing Results

Differences in CES-D scores at intake and completion of program.

Using a paired *t*-test, we tested hypothesis 1 for differences in CES-D scores before versus after the CR program. Participant's CES-D scores (n=132) ranged from 0 to 35 on intake of the program and decreased to 0 to 27 upon completion of the program. Patients had

significantly lower mean CES-D scores at the end of the CR program (6.87 ± 6.64) compared to their CES-D score before they started the program (8.79 ± 8.09; t=0.53, p=0.003; Table 2).

We further examined patients who self-reported as depressed using the CES-D score of greater than 15 (n=25). Table 3 demonstrates patients with a CES-D score greater than 15 had significantly lower mean CES-D scores at the end of the CR program (11.72 ± 7.75) compared to their CES-D score before they started the program (22.44 ± 5.87; t=0.19, p<0.001).

CES-D scores by procedure type, age and gender.

ANOVAs were performed to identify if there were differences in CES-D scores upon intake and completion by type of procedure and age. There were no statistically significant differences in CES-D scores upon intake and completion of the CR program by type of procedure and age (Table 4).

An independent t-test was conducted to analyze if there was a difference in CES-D scores upon intake and completion of the CR program based on gender. Our study demonstrated there were no statistically significant differences in CES-D scores upon intake and completion between males and females (Table 4).

Discussion

We hypothesized that there would be a difference in levels of depression at the beginning of a Phase II CR program in patient's post-cardiac event and by the end of up to 36 sessions. Our results demonstrated a significant reduction in depression scores after the program than before, thus demonstrating consistency in the literature that participation in a Phase II CR program, along with interventions tailored to the individual, can influence a patient's mental health (Gellis and Kang-Yi, 2012; Whalley, Thompson and Taylor, 2012; Pogosova et al., 2015; Klainin-Yobas et al., 2016). One possible explanation for our findings is that CR staff continually assess

the patient's overall health at each session – physical and psychological. Even if a CR patient did not self-report as depressed, the CR staff checked-in with the patient on how he/she is doing throughout the session and program – thereby explaining why coaching was used frequently. CR staff remained astute in assessing patient's overall health status throughout the continuum of the program – even if a patient did not self-report as depressed initially; however, at any point in the program the patient may experience a life-event that may change the psychological state of the patient.

We hypothesized that there would be a difference in the level of depression at intake and at the completion of Phase II CR patients post-cardiac event by type of cardiac procedure. Our study demonstrated no statistically significant differences in depression scores at intake and completion of the CR program based on the patient's type of procedure. Our findings do not support Szczepańska-Gieracha et al.'s (2012) study in which the type of procedure may influence depression level. However, our results are aligned to Pourafkari, Ghaffari, Shahamfar, Tokhmechian and Nader's (2016) study that demonstrated a higher prevalence of depression in patients who had coronary revascularization, but failed to demonstrate differences in levels of depression between medically managed cardiac patients and those who had coronary revascularization. One possible explanation for our findings may be patients with cardiovascular disease who are medically managed after a cardiac event (i.e. myocardial infarction) may not get a Phase II CR program referral from the cardiologist despite the physical and psychological benefit in reducing overall morbidity and mortality rates. Another possible explanation for our results may be the patient's psychological state had stabilized from the time of the cardiac procedure to the time of the initial CR intake session (approximately 6-8 weeks).

We hypothesized that there would be a difference in the level of depression at intake and completion of Phase II CR patients post-cardiac event based on gender. Our results showed no statistically significant differences in CES-D scores upon intake and completion of the CR program between males and females. This finding is inconsistent with previous studies (Grace, Yee, Reid and Stewart, 2014; Davidson, 2013; and Zimmerman et al., 2010) that determined depression was more common in females than males. One possible explanation for our results is the CES-D tool did not have any gender-specific questions that may influence different responses depending on whether the participant was male or female. In addition, the majority of the participants that attended our program were male. Perhaps if more women had attended, or had a program dedicated to women only (Hurley et al., 2017), the level of depression may have demonstrated a difference. Our organization may wish to explore this option of a gender-specific program and do further research on the effects of this type of program.

Finally, we hypothesized that there would be a difference in the level of depression at intake and completion of a Phase II CR program in patients post-cardiac event based on age. Age was not a statistically significant finding in our results. Our results are consistent with Casey et al. (2008) who also reported there was no significant difference between depression and age. Our nonsignificant finding on depression by age might be accounted for because the majority of the patients attending were between 65-79 years of age and not employed. Patients who were less than 65 years of age may have been employed or faced a barrier from attending (Casey et al., 2008). A larger sample size is needed to determine if age is a factor on level of depression.

Limitations

Main limitations of this study are related to the retrospective chart review design. Our analysis was limited to those variables pre-recorded within the facility CR SharePoint and EHR.

Data were limited due to patients' inconsistent completion of post-assessment forms despite having had attended at least 12 sessions. Other challenges included data missing from the EHR or placed in wrong sections. The study's sample size was a convenience sample and limited to a specific time frame and one facility within a large health system. Significant differences might have been found for depression scores at intake and completion of a Phase II CR program if the sample size had been larger.

Implications/Recommendations for Policy, Practice, and Research

The results of our study have implications for our CR program within the facility and organization to examine the types of interventions and the frequency of reassessment of depression after interventions are utilized by CR staff for Phase II CR patients. Results of the study will be shared with the key stakeholders within the organization with recommendations based on our findings.

Despite motivational interviewing techniques being used by our CR team, our study demonstrated an opportunity for improvement to increase the use of this intervention for patients self-reported with depression. Additionally, we recommend the organization's leaders place more emphasis on training for the CR team on how to use motivational techniques more effectively (Gellis & Kang-Yi, 2012). Further discussion is required with key stakeholders on assessment of resources and how to implement other interventions to individualize the plan of care for the patient. These interventions can include: referral to relaxation classes, music therapy (other), guided imagery and deep breathing exercises (Gellis & Jang-Yi, 2012).

Another recommendation to the stakeholders is to determine the frequency of reassessment of depression and evaluation of any interventions that had been used by CR staff. Our study demonstrated most patients attended an average of 10 weeks. To ensure CR staff

capture a participant's psychological well-being (especially those self-reported as depressed), our recommendation is for CR staff to complete a reassessment prior to mid-program (week 3 or 4), and again at week 10 for completion of the CR Phase II program.

Opportunity for improvement also exists in documentation of interventions for depression. Interventions for patients self-reported as depressed were initially documented, but documentation of interventions was often charted as N/A throughout the plan of care or no change. Therefore, we will recommend to the CR team to make assessment and documentation a priority by including an evaluation of the patient's mental health status with each significant milestone of the participant's program (Ski et al., 2012). Moreover, we will recommend periodic chart audits by CR leadership to ensure that assessments and appropriate interventions are being completed.

Although there was documentation for referral to the provider when a patient self-reported as depressed based on the CES-D scale, to promote the intervention of collaborative care (Huffman et al., 2014) the opportunity exists to consult with other members of the interprofessional healthcare team such as case managers, social workers, psychiatric nurse practitioners or other mental health professionals. We recommend that CR leaders start the discussion in which the aforementioned disciplines be brought in for consultation to enhance the CR program. Once the collaborative care professionals have been identified, we will recommend education of the CR staff on how and when to consult the team member when patient self-reported as depressed has been identified. These other members of the healthcare team may be able to provide resources to the patient that the CR staff member may not have otherwise been able to provide. Future discussions may include how to include referral to interprofessional

healthcare team members to patients not self-reported as depressed in the event circumstances change during the CR program.

The type of depression screening tool we are using may also be an opportunity to explore with the organization's stakeholders. Three of our 132 participants had identified him/herself as Hispanic, and the metropolitan area in which our study took place has a high number of Hispanic patients whose primary language is Spanish. Presently at our organization, a Spanish version of the CES-D is not being utilized although Smeer and Keefer (2011) report there is a free Spanish version available. Because the Spanish CES-D tool is not being provided at our organization, patients whose primary language is Spanish are being excluded from completing a CES-D form and may be excluded from self-evaluation and interventions for depression. Other tools that screen for depression (i.e. Patient Health Questionnaire-9 [PHQ-9]) are also available in other languages including Spanish and stakeholders may wish to consider this tool as an alternative for the health organization (Smeer and Keefer, 2011).

Further research is needed with a larger study sample to analyze how additional recommended interventions for depression (i.e. training CR staff in motivational interviewing techniques or consultation of interprofessional health team members) may have an impact on depression scores at intake and completion of a Phase II CR program. Among all 132 patients in our study, no interventions were offered to the majority of patients because the mean score was low (8.79 ± 8.09). Further research with a larger sample is needed to analyze if there are differences in depression at intake and completion based on the patient's type of procedure, gender or age.

Additionally, further research considering geographical location or climate is warranted. Our study was conducted in one facility of a large healthcare system in the Southwestern United

States; implementation of a screening tool for depression in patients whose primary language is not English is also recommended.

Conclusions

Cardiac rehabilitation programs aim at restoring a participant's physical and psychological well-being. Initial assessment of a participant's level of depression upon intake of a Phase II program using a validated tool for depression (in languages that reflect the population) can capture participants who may be considered depressed. Our study demonstrated self-reported depression was consistent with the literature of 20% of patients post-cardiac event (Sunquist et al., 2016), and the interventions for depression used by CR staff during the program significantly reduced the level of self-reported depression. Our study also revealed that the type of procedure, gender and age were not a significant factor in self-reported depression scores between intake and completion of a CR program.

Based on our study, recommendations to stakeholders included diligence in assessment of depression throughout the patients' CR ITP – particularly before the end of the patient's program. If at any time a patient self-reports as depressed, CR staff can then provide and document patient-centered interventions (i.e. coaching, stress management), with additional education on how to conduct motivational interviewing. Additionally, as recommended to stakeholders, a process needs to be developed and education provided on how CR staff can incorporate interprofessional, collaborative care. By incorporating these recommendations, this will ensure the patient's mental health is improved and promotes better outcomes in his/her cardiovascular recovery.

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Table 1 – Demographic and Clinical Characteristics

Variable	**N (%)** **132 (100)**
Procedure Type • Elective or emergent percutaneous coronary intervention (PCI) • Elective or emergent surgical intervention (CABG or valve procedure) • No procedure (medical therapy)	 77 (58.3) 49 (37.1) 6 (4.5)
Admitting Diagnosis • Unstable angina/NSTEMI • CAD • STEMI • Other	 9 (6.8) 63 (47.7) 4 (3.3) 56 (42.4)
Age • <65 • 65-79 • ≥80	 45 (34.1) 63 (47.7) 24 (18.2)
Gender • Male • Female	 82 (62.1) 50 (37.9)
Race • White/Caucasian • Black/African-American • Hispanic/Latino • Asian • Other	 108 (81.8) 15 (11.4) 3 (2.3) 2 (1.5) 4 (3.0)
Educational Level • Secondary school or less • Post-secondary school	 20 (15.2) 112 (84.8)
Marital Status • Not married • Married	 55 (41.7) 77 (58.3)
Employment Status • Employed • Unemployed	 30 (22.7) 102 (77.3)
Past Psychiatric History • No • Yes	 113 (85.6) 19 (14.4)
Substance Use • None • Tobacco use (chewed or inhaled) • Alcohol use	 107 (81.8) 11 (8.3) 1 (0.8)

• Recreational drug use	13 (9.8)

Table 2 – Hypothesis testing: Differences in CES-D scores at intake and completion of program (total group, n=132).

Tool	Intake (actual) Mean (SD)	Completion of Program (actual) Mean (SD)	Paired t-test	p value
CESD	8.79 (8.09)	6.87 (6.64)	0.53	0.003

Table 3 – Hypothesis testing: Differences in CES-D scores at intake and completion of program (Self-reported as depressed using CES-D score greater than 15, n=25).

Tool	Intake (actual) Mean (SD)	Completion of Program (actual) Mean (SD)	Paired t-test	p value
CESD	22.44 (5.87)	11.72 (7.75)	0.19	<0.001

Table 4 – Hypothesis testing: CES-D scores at intake by procedure type, gender, and age

Variable	Number (n)	CESD score Mean (SD)	Statistic	*p* value
Procedure Type			ANOVA 1.33	0.27
• Elective and emergent Percutaneous Coronary Intervention (PCI)	77	8.44 (8.00)		
• Elective and emergent surgical – CABG or valve procedure	49	8.69 (8.04)		
• No procedure	6	14.00 (9.19)		
Gender			Independent t-test 0.27	0.85
• Male	82	8.94 (8.24)		
• Female	50	8.54 (7.91)		
Age			ANOVA 1.52	0.22
• Group1 (<65 years)	45	10.36 (8.42)		
• Group 2 (65-80 years)	63	8.33 (8.03)		
• Group 3 (>80 years)	24	7.04 (7.30)		

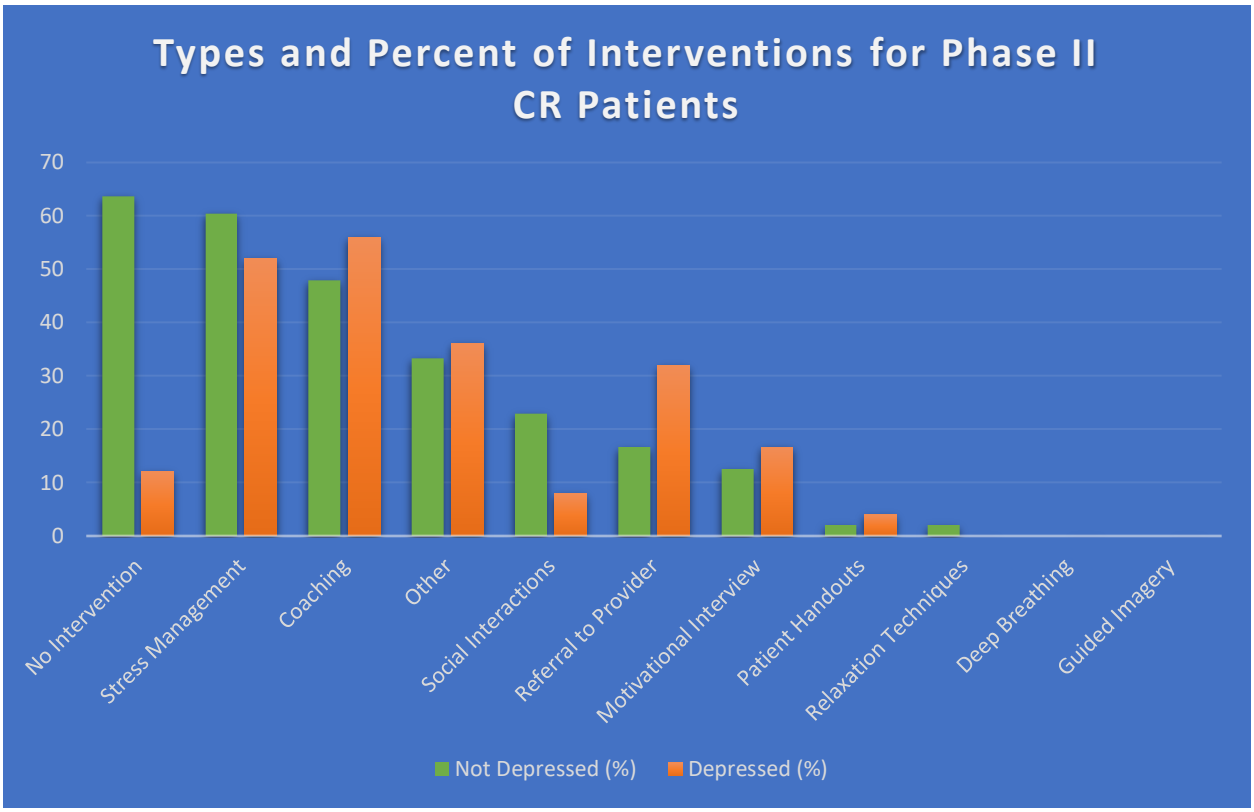


Figure 1 – Types and percent of interventions used by CR staff for Phase II CR patients for patients self-reported as not depressed and self-reported as depressed.

Appendix A

Variable Table with Theoretical and Operational Definitions:

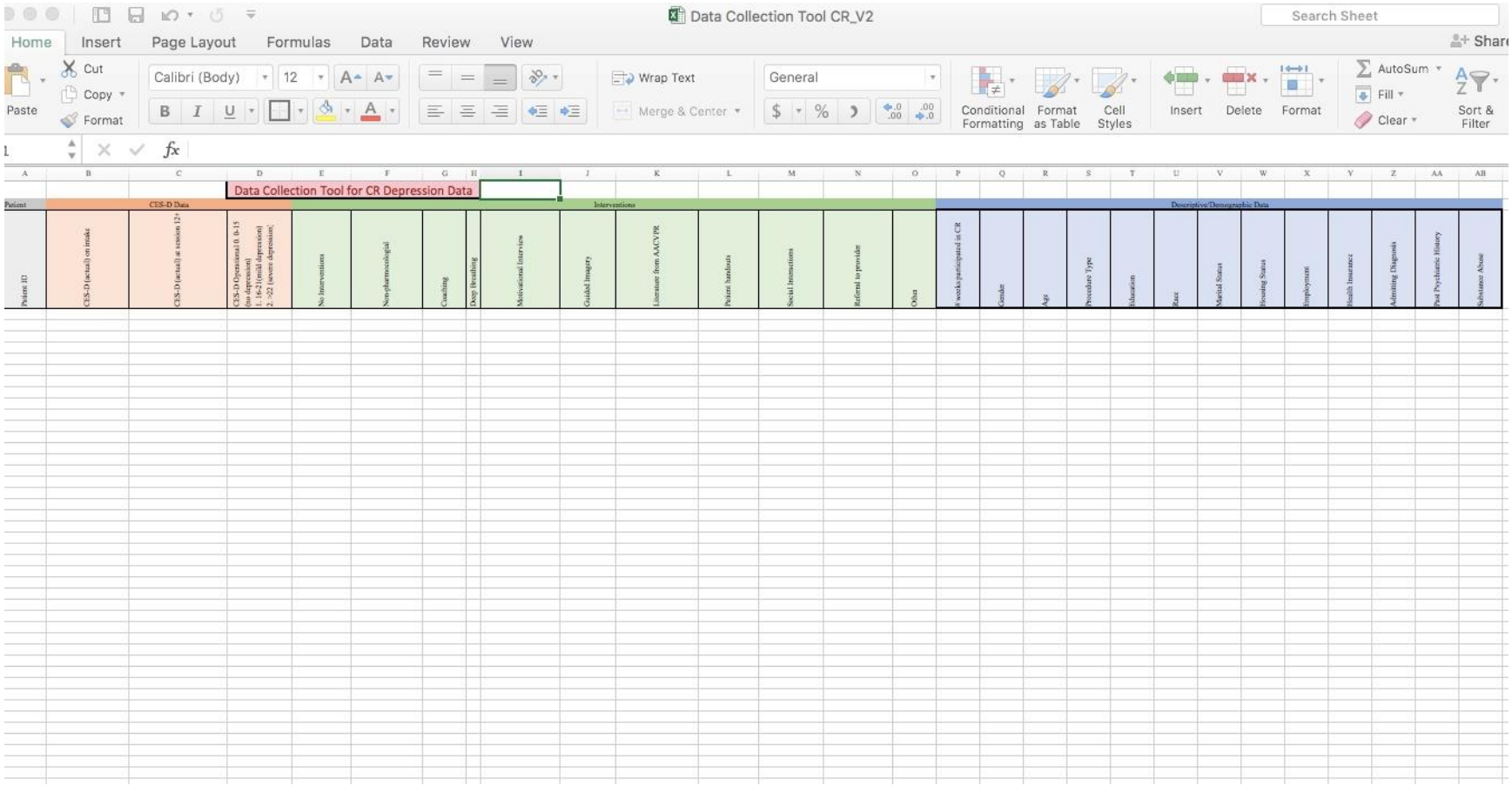
Depression Rates in Phase II Cardiac Rehabilitation (CR) Patients Variables

Variable	**Theoretical Definition**	**Operational Definition**
Dependent Variable		
Actual perceived level of depression using validated tool Center for Epidemiologic Studies Depression Scale (CES-D) upon intake (session 1)	Feelings of: sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness, and poor concentration	Actual CES-D score on intake (range 0-60)
Actual perceived level of depression using validated tool Center for Epidemiologic Studies Depression Scale (CES-D) at completion of CR program (session 12 or higher)	Feelings of: sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness, and poor concentration	Actual CES-D score at session 12 or higher (range 0-60)
Confounding Variable Cardiac Rehabilitation interventions for depression	Program consisting of physical and behavioral interventions to achieve baseline activity level prior to cardiac event Intervention of Cardiac Rehabilitation staff as recorded by CR staff in electronic health record (EHR) from CR staff flowsheet (patient visits)	1. No interventions 0. No 1. Yes 2. Coaching mechanisms 0. No 1. Yes 3. Deep breathing exercises 0. No 1. Yes 4. Motivational Interviewing 0. No 1. Yes 5. Guided imagery 0. No 1.Yes 6. Patient handouts 0. No 1. Yes 7. Social interactions with other CR participants 0. No

		1. Yes 8. Referral to provider for severe depression 0. No 1. Yes 9. Stress management class 0. No 1. Yes 10. Relaxation class 0. No 1. Yes 11. Referral to provider 0. No 1. Yes 12. Other 0. No 1. Yes
Total number of interventions used in CR program	Number of interventions used in patient's CR program	Actual number of interventions used throughout patient's program (0-12)
Number of weeks participated in Cardiac Rehabilitation	Number of sessions from start to stop	Actual number of sessions in the CR program
Independent Variables		
Gender (nominal)	Biological determination	1. Male 2. Female
Age (categorical)	The years a person has lived	1. <65 2. 65-79 3. ≥80
Procedure Type (categorical)	The type of cardiac procedure the patient is receiving Phase II cardiac rehab (post-cardiac event)	1. Elective or emergent percutaneous coronary intervention (PCI) 2. Elective or emergent surgical intervention (CABG or valve procedure) 3. No procedure (medical therapy)
Demographic and Clinical characteristics of the sample		
Educational Level	Level of education completed	1=Secondary school or less 2=Post-secondary school

Race	Biological or genetic traits based on various sets of physical characteristics	1=White/Caucasian 2=Black/African-American 3=Hispanic/Latino 4=Asian 5=Other
Marital Status	Status of current relationship	1=Not married 2=Married
Housing Status	Place of residence or living quarters	1.apartment/house 2.residential facility 3.homeless/shelter
Employment Status	Status of current employment	1.employed 2. unemployed
Health Insurance	Method of payment	0. no coverage 1. coverage
Admitting Diagnosis	Diagnosis of patient upon admission to hospital	1. unstable angina/NSTEMI 2. CAD 3. STEMI 4. Other
Past Psychiatric History	Whether patient has a history of previous psychiatric admissions or has had outpatient psychiatric treatment	0. No 1. Yes
Substance Use	Substances that may increase risk of CAD	0. None 1. tobacco use (chewed or inhaled) 2. alcohol use 3. recreational drug use

Appendix B – Data Collection Tool



Appendix C – Data Definition Codes

Patient ID Code	
***Actual* perceived level of depression using validated tool Center for Epidemiologic Studies Depression Scale (CES-D) upon intake (session 1)**	Actual CES-D score on intake (range 0-60)
***Operational* CES-D score) upon intake (session 1)**	0. 0-15 (no depression) 1. 16-22(mild depression) 2. >22 (severe depression)
***Actual* perceived level of depression using validated tool Center for Epidemiologic Studies Depression Scale (CES-D) at completion of CR program (session 12 or higher)**	Actual CES-D score at session 12 or higher (range 0-60)
***Operational* CES-D score) at completion of CR program (session 12 or higher)**	0. 0-15 (no depression) 1. 16-22(mild depression) 2. >22 (severe depression)
Number of weeks participated in Cardiac Rehabilitation	Actual number of sessions in the CR program
Age	1. <65 2. 65-79 3. ≥80
Gender	1=Male 2=Female
Educational Level	1=Secondary school or less 2=Post-secondary school
Race	1=White/Caucasian 2=Black/African-American 3=Hispanic/Latino 4=Asian 5=Other
Marital Status	1=Not married 2=Married
Housing Status	1.apartment/house 2.residential facility 3.homeless/shelter
Employment Status	1=Employed 2=Unemployed
Health Insurance	0. no coverage 1. coverage

Admitting Diagnosis	1. unstable angina/NSTEMI 2. CAD 3. STEMI 4. Other
Intervention	1. No interventions 0. No 1. Yes 2. Coaching mechanisms 0. No 1. Yes 3. Deep breathing exercises 0. No 1. Yes 4. Motivational Interviewing 0. No 1. Yes 5. Guided imagery 0. No 1.Yes 6. Patient handouts 0. No 1. Yes 7. Social interactions with other CR participants 0. No 1. Yes 8. Referral to provider for severe depression 0. No 1. Yes 9. Stress management class 0. No 1. Yes 10. Relaxation class 0. No 1. Yes 11. Referral to provider 0. No 1. Yes 12. Other 0. No 1. Yes
Total number of interventions used throughout CR program	0-12
Past Psychiatric History	0=No 1=Yes
Procedure Type	1. Elective or emergent percutaneous coronary intervention (PCI)

	2. Elective or emergent surgical cardiac (CABG or valve procedure) 3. No procedure
History of Substance Abuse	0. None 1. tobacco use (chewed or inhaled) 2. alcohol use 3. recreational drug use

Appendix D – Master Code List